

Tiny Open-Loop Atmospheric Sensing Technique

Completed Technology Project (2012 - 2012)



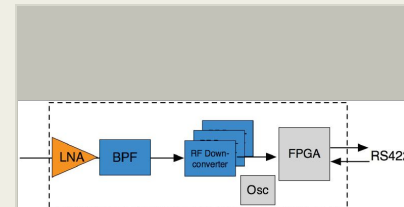
Project Introduction

We will design and fabricate a circuit card capable of retrieving real-time ionospheric and atmospheric refractivity from a low Earth orbit platform. The design must use less than 3 Watts orbit average power and process GPS signals as they rise through the lower troposphere. These data must be accompanied by post-processed orbit data with errors less than 2mm/sec velocity and 20 cm positioning. This design will form the basis of a cube-sat sized 3 Watt radio occultation sensor for LMR-sat.

The TOAST instrument is an open-loop processor of GPS navigation signals. The electronics fits on a single 10 cm square card with RF components and digital components on opposite sides. A dime-sized programmable chip (FPGA) acts as a signal processor for the GPS signals of up to 10 satellites. This FPGA is under the control of a very low-power Linux CPU which handles all of the tracking models for very weak GPS signals transecting the atmosphere. Unlike typical GPS receivers, TOAST tracks without tight phase-locked loop tracking of the received carrier phase. For any given GPS satellite to be observed, TOAST generates a precise 3rd order range and phase model and only updates the FPGA every 1 - 10 seconds. This allows the processor to be loosely coupled with the signal processing to the point where, given sufficient ground to space bandwidth, TOAST can be controlled by a ground-based CPU. However, in this implementation, a Linux CPU will accompany the RF and FPGA logic to provide real-time data.

Anticipated Benefits

None



Project Image Tiny Open-Loop Atmospheric Sensing Technique

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

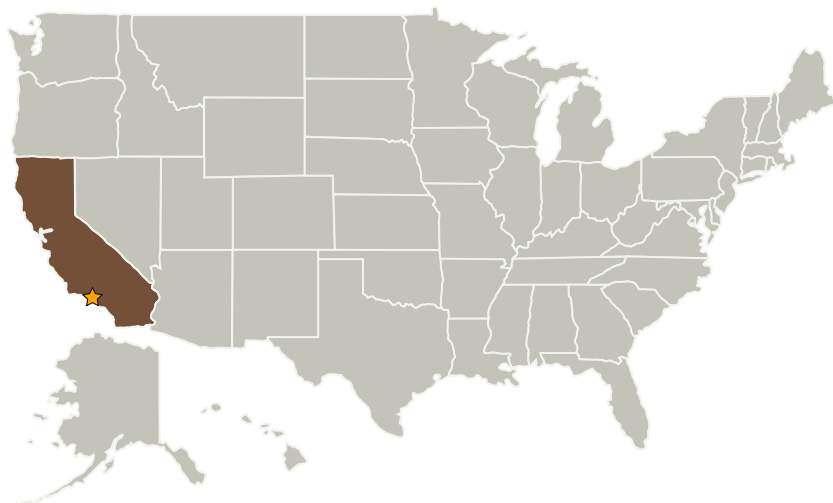
Center Innovation Fund: JPL CIF

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Primary U.S. Work Locations and Key Partners

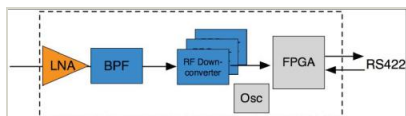


Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California

Images



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Project Image Tiny Open-Loop Atmospheric Sensing Technique
 (<https://techport.nasa.gov/image/1159>)

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Fred Y Hadaegh

Project Manager:

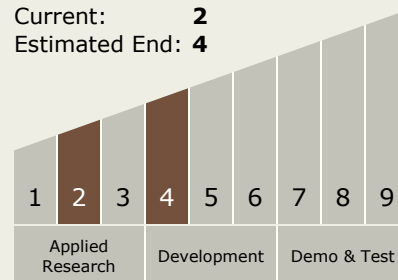
Jonas Zmuidzinis

Principal Investigator:

Thomas K Meehan

Technology Maturity (TRL)

Start: 2
 Current: 2
 Estimated End: 4



Technology Areas

Primary:

- TX10 Autonomous Systems
 - TX10.1 Situational and Self Awareness
 - TX10.1.3 Knowledge and Model Building